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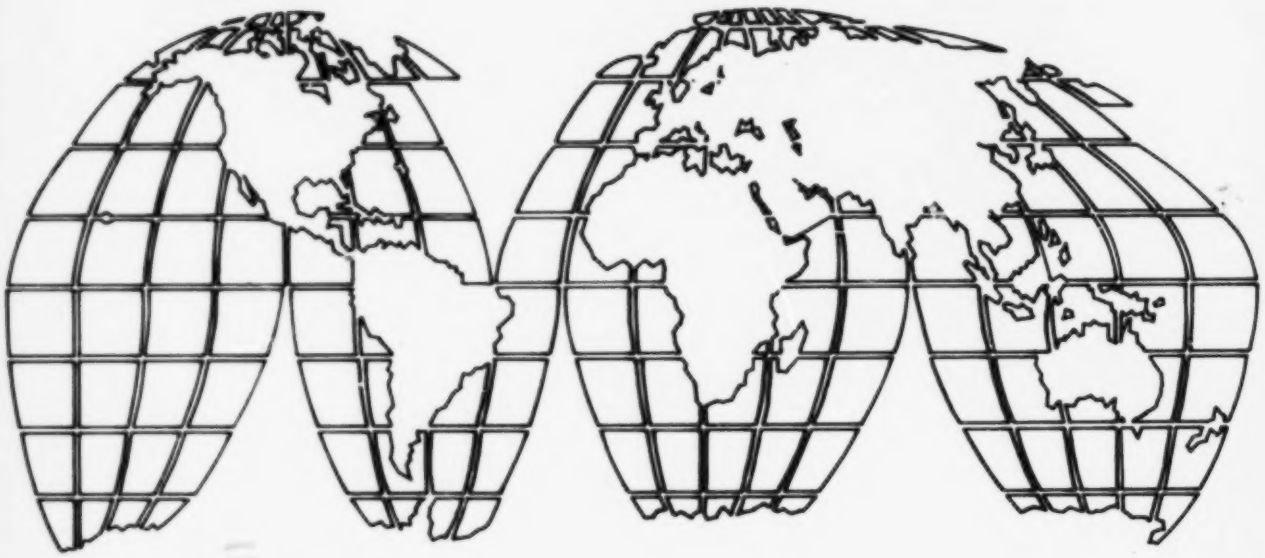
Policy Directions for Rural Water Supply in Developing Countries



April 1979

Office of Evaluation
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I

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II

POLICY DIRECTIONS FOR RURAL WATER SUPPLY IN DEVELOPING COUNTRIES

by
Ian Burton

A.I.D. Program Evaluation
Discussion Paper No. 4

The Studies Division

Office of Evaluation

Bureau for Program and Policy Coordination

U.S. Agency for International Development

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PREFACE

The purpose of this discussion paper is to present some ideas on the current state of knowledge about institutional, socioeconomic, and cultural constraints on modern rural water supply projects in developing countries. The paper attempts to summarize a consensus on some of the salient policy questions about how to design, install and maintain rural water supplies, and at the same time seeks to identify what is not known or poorly understood. Much of what follows describes areas of agreement about rural water supplies. The paper is not sharply at variance with existing policy. Nothing proposed here runs counter to what most of those on the day-to-day firing line consider to be appropriate. The paper does serve, however, to highlight certain aspects of policy that will need more vigorous and effective presentation if the efforts of the next decade are to prove worthwhile.

The preparation of this paper stems from the fact that we now stand at the threshold of the International Drinking Water Decade, 1980-1990, and U.S. AID together with a number of sister organizations is committed to a greatly expanded program of assistance to developing countries for rural potable water supply. A rapid expansion of the scale being contemplated runs the risk of funds being used with less than maximum effectiveness. If this risk is to be minimized, it is important that lessons from experience be gathered together and used as an imput in the planning of new programs.

Unfortunately, solid observations and analyses of the performance of rural water supply programs are not numerous enough. There is much anecdotal information in which reports of solid achievement are mingled with apologies and excuses. This paper attempts to marshall and organize the lessons of experience as a prelude to more detailed inquiries at the field level.

In so doing, the paper draws very substantially upon a workshop meeting of the AID Working Group on Rural Potable Water Supply, held in Washington, November 16 and 17, 1978. An earlier draft of this paper was tabled at the meeting and was the subject of much constructive comment. The discussions at the Workshop thus helped considerably in the development of this paper. It has also benefitted from the comments of Elizabeth Hunt, Anne U. White, and Gilbert F. White.

The first section of the paper draws upon a paper prepared earlier for the U.N. Water Conference. Other sections are based upon a survey of recent available and accessible literature; on my own field experience in the past five years in Africa and Latin America, and on discussions at the Ross Institute (Drs. David Bradley and Richard Feachem); at the International Reference Centre for Community Water Supply in The Hague; at the World Health Organization, Geneva; and at the British Ministry for Overseas Development in London (Mr. Bennell). Also a site visit was made in Nigeria in July 1978 including examination of the rural water supply situation in Oyo State in the vicinity of Iban and Oyo City.

In addition, I have benefitted greatly from advice and discussions with several people at AID headquarters in Washington, D.C. A special thank you is due to Dr. Dan Dworkin both for his encouragement and his sense of urgency.

About the Author

Ian Burton is a geographer interested in the relation between man and the environment. He is a Professor and a member of the Institute for Environmental Studies at the University of Toronto, Canada. He has served as a consultant to the Governments of Canada, India and Tanzania and to UNESCO and UNEP on resource problems in developing countries. He recently served as a consultant to the International Development Research Centre of Canada on rural water supply and sanitation. He is the author of a number of articles in the field of rural water supply in developing countries.

The views and interpretations in this publication are those of the author and should not be attributed to the Agency for International Development or to any individual acting in their behalf.

SUMMARY

The purpose of this paper is to survey the current state of knowledge on design installation and maintenance of rural water supply systems. The present interest in rural water supply stems from a change in attitudes of donors and host governments toward the provision of basic human needs to the poorest regions and peoples in the developing world.

Present statistics indicate that it may be possible to provide safe water for everyone during the 1980-1990 period designated the International Drinking Water Decade. To do so, however, will require a massive level of effort and investment above and beyond anything yet attempted. If the present rate of progress, between 1971-1975, is projected to the end of the decade, only two-thirds of the rural population would have reasonable access to safe water.

The results on a regional basis are uneven. Africa is making rapid progress in providing rural water supply and may equal Latin America, which had been far ahead, by 1980. Southeast Asia represents the major problem. Over sixty percent of the world population without reasonable access to water is in this region.

In preparation for the water decade, there are a number of evaluations underway. These include studies by OECD, UNICEF-WHO, IBRD, International Research Center, and a number of bilateral agencies including AID. These evaluations have one thing in common, an emphasis on the non-hardware components of rural water programs.

The problem of maintaining the system once they are installed is one of the key elements in the long-term success or failure of rural water schemes. There are three reasons for failure: the technology, the capability, and motivation. There are some situations where the technology is too complex for local maintenance, but in most cases lack of spare parts and motivation are more often to blame for system failure.

While there are general policy directions which may be suggested to ensure successful rural water programs, there is no one blueprint that will serve all countries. Appropriate, cost effective hardware that represents an incremental improvement in existing water systems and trained people at all levels are required for successful programs. To the extent possible, hardware should be uniform to facilitate the purchase and stocking of replacement parts.

There is a need to strengthen the capacity of national water programs. Unless this takes place, there may be no sustained progress. In addition there must be a commitment of funds to provide for needed operational materials and spare parts. Commitment at all levels will help insure continual success of rural water efforts.

Successful programs will also require balance between hardware, community involvement, and repair and maintenance. At the present the major bottleneck may be lack of persons for implementing projects and funds for operation and maintenance rather than in a shortage of capital funds.

One useful approach may be to fund programs rather than projects. This would require fewer trained people in both the donor and host countries. Such an emphasis could require program performance reports to enable donor host country to monitor, evaluate and revise ongoing programs.

There are two activities which AID should consider: rehabilitation of existing systems and development of methodologies to measure consumer satisfaction with water systems.

There are some obvious steps which are needed in the rural water area. These are:

--To keep abreast of technological developments

--Assess the need for manpower training and assist in development of teaching and training materials in local languages

--Encourage local manufacturers of water supply hardware

--Evaluate and strengthen the ability of national organizations and programs

--Provide materials for health community involvement guidelines and materials

--Finally, what is needed is to collaborate and coordinate with other agencies active in the rural water effort. It is an area in which efforts by AID would be welcome and perhaps even effective. If such an effort were to succeed, it would be more valuable than any other idea achieved in this paper.

1. THE WORLD SITUATION AND AID's ROLE

1.1 A Change of View

Over the past decade there has been a sea-change in the prevailing ideas about rural water supply and sanitation. The conventional view saw provision of improved water supply to rural populations in developing countries as a low priority item both in the plans of national governments for development and in the array of international and bilateral programs credited to be of assistance to national governments. The rationale for this position rested largely on the grounds that investment in water supply for domestic purposes is not directly productive and, therefore, does not contribute effectively to the development process. Indeed investment in domestic potable water supply schemes was often opposed on the grounds that it represents a misallocation of scarce capital resources to premature improvement in social amenities. In this set of circumstances those advocating improved water supplies were driven to try to justify investments by showing that social gains exceeded costs and, in particular, that the health improvements alleged to follow from safer water did lead to higher productivity, for example in agriculture.

Considerable effort was expended in such research exercises, almost all of which proved rather unconvincing. Health improvements were hard to substantiate, and could not be attributed with confidence to water and sanitation when many other factors were also changing. When health improvements were shown, it did not invariably follow that productivity would increase. The attempt to demonstrate and measure social benefit from improved water supplies in economic terms was intellectually and scientifically frustrating exercise and it served to convince only those who already knew that safe water should have higher priority. In the absence of convincing economic evidence the hard-liners, exemplified most strongly in the development banks, looked to ability and willingness to pay as the criteria for investment. Few investments were made, and the number of people classified by the World Health Organization as "without reasonable access to a safe and adequate supply of water", climbed steadily higher.

When the change came, it stemmed not from the more technical economic arguments about benefits and productivity, but from a more basic re-thinking about the purposes of development that had more to do with morals and politics than

with economics. In the late 1960's concern about the quality of life began to erode preoccupation with gross national produce. In developing countries people began to question the purpose of struggling hard to increase the national product if large segments of the population remained largely unaffected and saw no benefit from the development effort. Encouraged by changes of attitude and policy in the development banks, developing country governments no longer found the idea satisfactory that the benefits of investment in directly productive investment would eventually "tricke down" to the poorest and most inaccessible of their populations. The idea began to be promoted that development should be for all the people, and that some programs should be directed specifically towards the poorer regions of the country and segments of the population, so that all should receive some early benefit of development and thereby be drawn more actively into the process of social and economic change and modernization.

In light of this new feeling, rural water supply and sanitation rose dramatically from the status of a neglected Cinderella of programs to something of much higher visibility and priority. This new concern was first dramatically made evident at the U.N. Conference on Human Settlements (Habitat) held in Vancouver in June 1976. A recommendation adopted in Vancouver states that:

> (a) In the less developed countries, nearly two-thirds of the population do not have reasonable access to safe and ample water supply, and even a greater proportion lack the means for hygienic waste disposal.
>
> (b) SAFE WATER SUPPLY AND HYGIENIC WASTE DISPOSAL SHOULD RECEIVE PRIORITY WITH A VIEW TO ACHIEVING MEASURABLE QUALITATIVE AND QUANTITATIVE TARGETS SERVING ALL THE POPULATION BY A CERTAIN DATE; TARGETS SHOULD BE ESTABLISHED BY ALL NATIONS AND SHOULD BE CONSIDERED BY THE FORTHCOMING UNITED NATIONS CONFERENCE ON WATER.
>
> (c) In most countries urgent action is necessary to:
>
> (i) Adopt programmes with realistic standards for quality and quantity to provide water for urban and rural areas by 1990, if possible;
>
> (ii) Adopt and accelerate programmes for the sanitary disposal of excreta and waste water in urban and rural areas;

(iii) Mobilize popular participation, where appropriate, to cooperate with the public authorities in the construction operation and maintenance of infrastructure;

(iv) Plan water supply and the sanitary disposal of waste together in the framework of national resource planning;

(v) Reduce inequalities in service and access to water as well as over-consumption and waste of water supply;

(vi) Harmonize and coordinate the interests and efforts of local governments and other public bodies concerned through the appropriate planning by the central government;

(vii) Promote the efficient use and reuse of water by recycling, desalination or other means taking into account the environment impact;

(viii) Take measures to protect supply sources from pollution.

The hopes expressed in the Habitat Resolution suggest that the nations of the world are now ready and impatient for a substantial acceleration in the rate at which rural water supplies and sanitation facilities are being improved in developing countries. This was borne out at the U.N. Water Conference (Mar del Plata, February 1977), where the aspirations of the Habitat Roslution were reaffirmed and the 1980-90 decade was designated the International Drinking Water Decade.

1.2 What the Statistics Show

An examination of the World Health Organization's statistics on water supply shows that realization of the goal of safe water for practically everybody by 1990 may be possible, but that it will require efforts substantially above and beyond anything previously attempted in this area.

There is no global statistics prior to 1961. The first attempt at a comprehensive global assessment of rural water supply was made in 1970 (WHO 1972) and a series of revised estimates for 1975 were made in the Mid-Decade Progress Report (WHO A29/12, 1976).

The 1970 statistics assembled and analyzed by the World Health Organization showed that only 12% of the rural population in 90 developing countries (excluding China) had "reasonable access to safe and adequate" supplies of water. The publication of this statistic and its widespread use in reports and speeches helped to increase awareness of the unsanitary conditions in rural areas and to alert the international community to the need for swift action. (WHO 1972)

In light of the 1970 picture, the target set for the Second U.N. Development Decade was a doubling of the percentage of rural population with reasonable access to safe and adequate water supply from 12 to 25%. This entailed the provision of improved supplies to an estimated 217 million rural dwellers over the decade at an estimated cost of $2.8 billion (1970 values). These figures suggested that the average investment over the decade should be $280 million annually, compared with the estimated level of expenditure in 1970 of $138 million. To many it seemed that at these prices the goal of doubling the percentage of people supplied was unattainable by 1980. It was also pointed out that even if the target was to be reached, the absolute number remaining without improved supplies would be larger at the end of the decade than at the beginning, due to rural population growth. If projected to the end of the century the target rate of progress for 1970-80 would still leave 50% of the rural population without benefit of any improvement (see Figure 1 on following page). Clearly a higher level of aspiration is widely shared among the nations, and major efforts are needed to improve present performance and future prospects.

TABLE I. Programme for rural water supply in 90 developing countries 1970-1980 (population in millions)

Type of Supply	1970 1970		1980		Increase 1970-1980	
	No.	%	No.	%	No.	%
Access to safe water	140	12	357	25	217	155
Without access to safe supply	1026	88	1081	75	55	5
Total population	1166	100	1438	100	272	23

Source: World Health Organization, Twenty-Fifth Health Assembly. Community Water Supply Programme. Progress Report of the Director-General. Document A 25/29 Geneva. April 1972.

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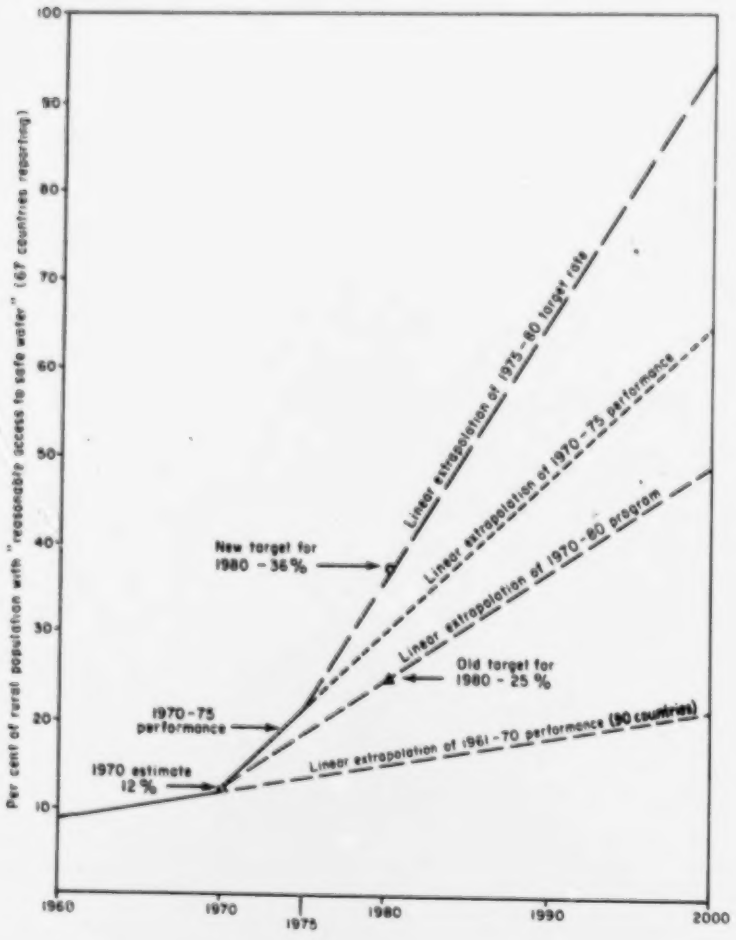

Figure 1. Linear extrapolations of rural populations with 'reasonable access to safe water' based on 1961-70 performance, 1970-80 programme, 1970-75 performance and 1975-80 target rate.

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Since the publication of the 1970 estimates and the adoption of the 1980 target of 25%, a major new effort has begun to take shape. This could be detected first in the increased interest and determination being shown in the national governments of the developing countries themselves. Many governments have moved since 1972 to accord higher priority to rural development including water supply and sanitation improvements. This resolve at the national level was supported by increased interest among the international agencies and by multilateral and bilateral donor organizations. The lead agencies in the U.N. family, chiefly the World Health Organization, UNICEF, and the U.N. Development Programme have been strengthening and enlarging their activities in this sector whenever possible. The movement culminated in the Habitat Resolution and the declaration of the International Drinking Water Decade 1980-1990 already mentioned.

Some early encouragement has come in the form of the statistics revealed in the Mid-Decade Progress Report prepared by the World Health Organization. This shows that the progress made to 1975 was in excess of the rate required to achieve the 1980 target of 25% (WHO 1976). The new regional targets adopted by WHO in 1976 indicate a net global increase from 25% to 36% on a 'global' basis (see Figure 1). The 1971-75 performance rate extended to 2000 A.D. would result in the achievement of improved supplies for almost 70% of the rural populations. Linear extrapolation of the 1975-80 target rate would, if carried out in practice, achieve improved supplies for 95% by the end of the century.

The rate of progress has varied considerably among the regional groupings of countries used in WHO statistics (Figure 2). The rate of achievement has been good in Africa and the Western Pacific Regions and both are expected to reach a new target of 35% by 1980. Improvement has been surprisingly slower in the Americas, and it will be difficult now for the Latin American countries to achieve the 'Santiago goal' 1/ of 50% by 1980 without greatly expanded efforts.

Viewed on a world scale, the mass of the problem lies in Southeast Asia (Figure 3). Approximately 62% of the world population remaining without improved supplies in 1975 is to be found in that region - over 37% in India alone.

1/ Goal of 50% of rural population was set at the conference of Ministers of Health of the Americas lll Santiago, Chile 2-9 October 1972.

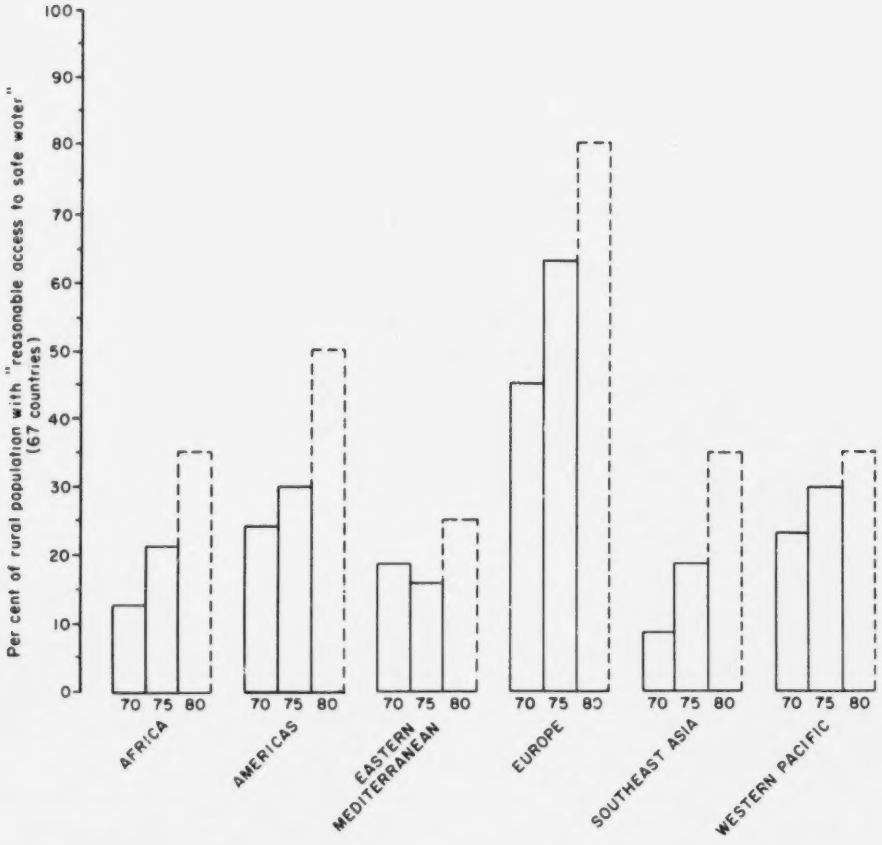

Figure 2. Progress by regions 1970-75 and revised 1980 targets

Source: WHO Community Supply and Wastewater Disposal, Med-Decade Progress Report A29/12 Rev. 1 Geneva 1976.

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Countries reporting:

AFRICA:
- Benin
- Guinea
- Ghana
- Kenya
- Madagascar
- Mauritius
- Niger
- Rwanda
- Swaziland
- Togo
- Uganda
- United Republic of Tanzania
- Upper Volta
- Zaire
- Zambia

AMERICAS:
- Argentina
- Barbados
- Bolivia
- Chile
- Colombia
- Costa Rica
- Dominican Republic
- Ecuador
- El Salvador
- Guatemala
- Guyana
- Haiti
- Honduras
- Mexico
- Nicaragua
- Panama
- Paraguay
- Peru
- Uruguay

EASTERN MEDITERRANEAN:
- Afghanistan
- Bahrain
- Cyprus
- Ethiopia
- Iran
- Iraq
- Kuwait
- Libyan Arab Republic
- Oman
- Pakistan
- Qatar
- Saudi Arabia
- Somalia
- Sudan

WESTERN PACIFIC:
- Fiji
- Lao People's Democratic Republic
- Malaysia
- Papua New Guinea
- Philippines
- Republic of Korea
- Singapore
- Tonga
- Western Samoa

EUROPE:
- Algeria
- Turkey

Figure 3. Regional distribution of rural pouplations without reasonable access to safe water. 1975. (67 countries reporting)

Source: WHO Community Supply and Wastewater Disposal Med-Decade Progress report A/29/12 Rev. 1, Geneva 1976.

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1.3 Some Caveats

The global rate of expansion of the improvement effort has been better than expected, but the magnitude of the problem in Southeast Asia is cause for concern. If the situation in that region could be substantially improved, the world picture would also look radically different. From an international perspective, it appears that external assistance should be concentrated where the large mass of the problem lies.

The relatively slow progress of the Latin American countries is also somewhat alarming, since those countries have always been regarded as the leaders in the developing world as far as water supply and sanitation is concerned. It now appears possible that Africa could have caught up, or even be in a better position by 1980. The Mid-Decade Progress Report suggests that the relatively slower performance of the Latin American countries in the rural sector is due to the allocation of insufficient resources. A factor that might lie behind this is that much of the rural settlements in Latin America still without adequate water supplies is in dispersed or scattered farmsteads, or only semi-concentrated populations. After the more concentrated rural settlements have been supplied, it becomes increasingly expensive to reach and supply the more dispersed settlements (Pineo and Donaldson 1976*). The phenomenon of a declining rate of progress once more accessible rural communities have been reached might also occur in other regions. It is well known that the larger communities, those nearer to major cities, and those more wealthy and with more influence, tend to be reached first. The accelerating rate of improvement suggested by Figure 1 should not lead to quick optimism. The greater costs of reaching poorer and more remote rural people, may come into operation sooner rather than later.

There are more reasons for caution. The reliability of the data collected in the WHO questionnaire surveys can vary considerably. The Mid-Decade Progress Report states, "The data obtained from this survey should be considered as order of magnitude estimates only." The data are also liable to two sorts of systematic error. First, the number of people with improved supplies may be over estimated because a national programme may assume that once an improvement has been provided it continues indefinitely to be available. Experience suggests that this assumption cannot safely be made.

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*All citations are found in the Bibliography, page 39.

Second, and to some extent compensating for the first source of error, it is sometimes assumed that unless a village has been supplied with a water supply improvement through a national programme, no improvement has occurred, and that by definition the water used must be unsafe, inadequate in quantity or not accessible. This neglects the efforts that are sometimes made by communities to help themselves, or the assistance that they may receive from non-governmental bodies.

It would be cheering to say that these two sources of error in the statistics cancel each other out. They probably do not, and the likelihood is that the statistics suggest that the situation is in fact better than it is. There are additional reasons for concern:

--Even where improved water supplies are technically sound, and adequate provision is made for proper operation and maintenance, it does not follow that the number designated to be served will be an accurate reflection of what happens. If the improvement is successful with the local population, many more people may be drawn to a new source of water than anticipated. This can result in long queues for water and can interfere with the proper functioning of the system. More people may be supplied than anticipated, but the adequacy of the supply and eventually its safety may be jeopardized.

--Where wells are constructed at widely scattered points, people may be drawn from great distances to fetch water. This can result in excessively heavy use in times of drought or dry season, and little or no use when water is more abundantly available in more convenient but unprotected sources such as surface streams or ponds.

--Where new or improved rural water supplies are properly maintained and operated and are well used by the local population, the situation may still fall short of the ideal. Often water has to be carried by bucket, kerosene can or traditional clay pot to the place of residence. Contamination can occur in transport or in the home, and thus offset the health benefits gained from high quality supply at the source. Such health benefits can also be diminished if improvements in water supply are not accompanied by simultaneous improvements in sanitation, especially in traditional practices of excreta disposal.

--It has been widely observed that rural populations do not necessarily make use of improved sources of water. They may be too far away in the wet season relative to other seasonal sources. They may not seem worth the effort of maintenance involved and they may not appear to offer significant advantages over traditional sources of supply, The reasons for the failure of rural water supply schemes are legion. Rural populations may object to the taste of ground water, they may dislike chlorination, or they may simply not wish to avail themselves of a source for a variety of other reasons such as contact with neighbours whom they prefer to avoid.

--These caveats do not apply with equal force on all situations. There is a wide diversity of response from place to place. Settlement type, wealth, accessibility, community organizations, and water availability all affected the planning for rual water supply projects. A discussion of problems and a typology of situations encountered in rural water supply projects are discussed in Appendix A.

--Finally, even at the most optimistic levels it is clear that there are still on the order of one billion people living in rural areas of developing countries today who are forced to rely on unsafe sources of water, or who must spend hours of time and much effort in obtaining safe water for their daily needs. To reduce this number (which is constantly growing by natural increase) to practically zero at the end of the century will require a Herculean effort.

Thus, there are grounds for optimism but not complacency.

1.4 The Role of AID or 'Just What Are We Getting Into?'

The U.S. Agency for International Development stands at the threshold of major expansion in its programme of assistance for improvements in rural water supply and sanitation. From the present level of approximately $50 million annually, there is consideration that the available funds will rise to a level on the order of $250 million annually during the early years of the 1980-1990 decade. Such an increase would represent a major United States commitment to the plan for an International Drinking Water Decade.

Is the U.N. plan, and particularly the U.S. commitment to it, well conceived and what are the possible dangers in it? The economic and moral arguments for attempting to ensure that all (or almost all) the world's population has reasonable access to a safe and adequate supply of drinking water by 1990 have been made many times and need not be separated here. There is, however, a major cause for concern. Experience with rural water supply and sanitation schemes during the past two decades has been at best mixed and at times downright discouraging. Enough is known that we can be safe in the assertion that rural water supply and sanitation schemes are much more complex and difficult to carry off successfully than it first appears. A major cause for concern is that projects often do not remain viable at the local level. Too frequently they fall into disrepair or are abandoned. It has been recently claimed, for example, that "from 35% - 50% of the water taps in rural areas are out of order 3 to 5 years after their construction" (Imboden 1977). The accuracy of this and similar estimates cannot be assured, but it is symptomatic of a widespread and genuine concern based upon experience in many countries.

The technological requirements are deceptively simple. You pump water from a tube well or from a surface source, such as a stream or lake; you provide a minimum of treatment (filtration and chlorination) if necessary and appropriate; and you pump the water or feed by the gravity-flow through a distribution network of pipes to the people who need it. The consumers obtain the water from a tap in their house or compound or if a lower level of service is provided initially, from public standposts. Nothing could be simpler and certainly no insuperable problems arise. In time of war it has long been possible to move large armies of men from country to country and continent to continent, building their own water supply systems as they go. Why is it then, that there remain today over a billion rural people without access to safe and adequate supplies of drinking water?

Like pollution, the drinking water problem is a product of the rapid transformations of the last century. Clearly, every human settlement had access to a water supply. People cannot survive long without water. And so today everyone has water. Growth of population, greater pressure of people on the land now, means that supplies that were once adequate will no longer serve. The simple and traditional ways of obtaining water, for example the village hand-dug well from which water is drawn in a bucket hauled up by hand or with the help of a simple winch, are no longer adequate in quantity

of supply, and with pressure of heavy use in crowded areas are likely to become contaminated with fecal matter and hence with bacterial disease. The same is true of streams, springs and other surface supplies. Moreover, greater population pressure means that in some places, especially arid or semi-arid lands or those regions with a pronounced seasonal concentration of rainfall and a dry period, water is likely to be physically in short supply at some times of the year or in particularly dry years.

It is true to say therefore, that by any standards the drinking water problem has largely been a creation of the early phases of the development process, and that in many regions there has been a decline in the drinking water supply either in quantity, quality or accessibility, or all three, over the past several decades.

The challenge to international development aid is to rectify and reverse this trend, and as we have stated, the basic technology required to do this is available and is really quite simple. During the past 25 years there has been a steady growth of national water supply programs in the developing countries. After an initial focus on the major urban areas, the national programs have increasingly been enlarged to encompass the rural water supply problem in their area of responsibility. This trend has been encouraged and supported by the U.N. organizations involved (i.e. WHO, UNICEF and others) and supported financially by U.S. AID and a wider group of aid agencies and donor organizations, governmental as well as non-governmental.

As a major new global effort takes shape, it is important to take stock of what is known and not known, and to think critically about the policy directions to be followed. Starting out on the wrong foot could lead to a massive misallocation of funds. The spectre that inevitably haunts any new major and ambitious thrust in rural water supply, is that a decade hence there will be a lot more pumps and pipes in the villages of the third world, and that too many of them will be seen to be not working at all, or performing far short of their designed capacity. It is as a contribution to the development of understanding that can prevent such a calamity from occurring that the rest if this report is addressed.

2. EVALUATION STUDIES

When embarking upon a major experience, it is the beginning of wisdom to evaluate critically what has gone before.

Until recently, evaluation studies have been of two main types. The most popular are the "windshield" surveys in which a series of short-duration visits are made to a number of projects by a small "evaluation" team or an individual. This approach has yielded a lot of information of an unstructured and noncomparable sort. It is good for forming impressions (especially for those engaged in the surveys) but it hardly provides a basis for considered action.

In the other type of study, "evaluation" is equated with "impact". In the case of water, the intent of most impact studies is to show that the supply as led to a beneficial impact upon health. A number of such studies have been described in a World Bank Report (Saunders and Warford 1976). In general they suggest that the direct health benefits to be gained depend on a wide range of impacts and that water supply improvement if carried out by itself is not sufficent to provide substantial health benefit. Further, health benefits, when they do occur, are not necessarily translated into economic benefits of a productive sort.

A rash of new evaluation studies is now being launched in anticipation of the International Drinking Water Decade. These include studies by a number of international organizations (OECD, UNICEF-WHO, IBRD, and International Research Center, as well as by bilateral aid agencies. In addition to U.S. AID plans in this area, evaluation studies are also being carried out by the Canadian International Development Agency in (Ghana) and by Swedish SIDA (in Tanzania). It is likely that other bilateral aid agencies are doing or thinking of similar studies.

At the present time, there appears to be no coordination between any of these evaluation efforts and no plans to integrate their separate findings.

The new studies vary markedly in their methods and aims. Brief descriptions follow of six studies being carried out by international agencies.

2.1 Organization for Economic Cooperation and Development (OECD)

The Development Centre at OECD has adopted a predominantly comparative and statistical approach to evaluation. In-depth case studies are rejected in favor of collecting data from a large number of countries. It is proposed to study in this manner a minimum of thirty water supply projects (not yet selected). Data are to be collected at three levels: the national policy level (up to 30 countries); the project or regional program level (30 projects); and the village level (numerous villages). Data are to be collected by means of questionnaires administered at all three levels.

The questionnaires are designed to obtain comparative information on many aspects of water supply development including, national organizations, and community participation at the village level. The test of success which is specifically espoused is the question, 'does the project continue to function 3 to 5 years after installation?'

The OECD proposed study is described in detail by the consultant (Imboden 1977). The organization has carried out a pilot study in seven African countries. Results are reported by Bennell (1978).

2.2 UNICEF-WHO (Joint Committee on Health Policy)

A study for UNICEF-WHO is now nearing completion. This study is intended to evaluate both water supply and sanitation as a component of primary health care. The two main components of the study are a search and synthesis of documentary materials, including published papers and materials in agency files, and a series of commissioned national case studies in 12 countries. The documentary materials are being studied by two consultants (Adolfo Mascarenhas and Allison Howell) and the national studies have been requested from national governments (and their national water supply and sanitation agencies) and paid for directly. Reports had been completed for nine countries by July 1978. These are Bangladesh, Bolivia, Columbia, Ghana, India, Iran, Nepal, the Philippines and Roumania. The reports are confidential, and may not be seen by AID consultants.

Preliminary indications are that the report of the study will bring to light new information in the area of community participation and that its major merit will be to place water

supply and sanitation together in the context of primary health care. A preliminary draft of the report is circulating privately (UNICEF-WHO Joint Committee on Health Policy, 1978).

2.3 IBRD-1 The Pineo Report

An International Bank for Reconstruction and Development study was commissioned in 1976. A consultant, Charles S. Pineo, visited eight developing countries (Peru, Colombia, Dominican Republic, Kenya, Upper Volta, Korea, Malaysia and Bangladesh) for approximately ten days each. A series of country reports are available (IBRD September 1978), and each deals with the following topics:

i) history of the national program

ii) administration of the national program

iii) community level promotion and community participation

iv) technology and design

v) selection of communities for projects

vi) house connections, water rates and financing

vii) materials, equipment and construction

viii) operation and maintenance

ix) excreta disposal

The Pineo study for IBRD is in effect a "windshield survey" type described above. It provides up-to-date information on the status of country plans and programs, and permits some comparative evaluation based on first hand observations of a single investagor. Evaluations of this type require relatively little time to complete and do lead to an overview criteria for project success and failure.

The Pineo report covers similar ground to that proposed in the OECD study, and carried out in the UNICEF-WHO study, but is not so detailed and does not focus on sanitation or on primary health care. It is primarily a water supply report.

2.4 IBRD-2 Appropriate Technology

A second World Bank study has been conducted during the period 1976-78 to inquire into and evaluate appropriate technology for water supply and sanitation in rural areas and for the urban poor.

Twenty countries have been included in the overall study which has a budget of $6 million. They are Japan, Taiwan, Korea, Indonesia, Malaysia, Vietnam, India, China, Afghanistan, Egypt, Sudan, Botswana, Ghana, Nigeria, Tanzania, Zambia, Colombia, Guatemala, El Salvador, and Nicaragua.

A large number of reports have appeared or are in preparation. The outcome of the project will be books and field manuals designed to aid decision makers in developing countries, development agencies, and consultant organizations to evaluate alternative technologies both technically and economically. One report available in draft form for Nicaragua illustrates the nature of these evaluation studies (IBRD, February 1978).

2.5 International Reference Centre - Evaluation Handbook

The IRC (The Hague) is sponsoring the development of a handbook for evaluating rural water supply projects. A draft has been written and is being reviewed. It has been prepared by Richard Feachem of the Ross Institute, London.

The handbook is divided into sections on how to measure and evaluate the following components of water schemes:

--technology

--costs

--water use

--water quality

--health problems and health benefits

--local organizational capacity

--effectiveness of education/extension component

--distribution of benefits

--administration - planning, construction, operation, maintenance

--financing - reserve policy and ability to pay

--economic benefits

The handbook contains suggestions for field evaluation methods and research design. It stresses the importance of evaluation in the field and at the village level rather than questionnaires designed at national or international levels, and taken or sent out from agency headquarters. In this respect the approval contrasts sharply with the questionnaire or protocol approach described in the OECD study design and used in the UNICEF/WHO Joint Project (IRC - Ross Institute 1978 draft).

2.6 International Reference Centre - Extension and Community Participation

In addition to the Evaluation Handbook, the International Reference Centre is in the initial stages of a project to develop guidelines for community participation, and intends to formulate an action plan for furthering international efforts.

The focus of this IRC activity is on community participation in all aspects of water supply development. (It is linked to another IRC project on slow and filtration (IRC-WHO 1978.) So far an annotated bibliography has been produced (C. van Wijk-Sijbesma 1978), and other materials are in preparation but not yet available for circulation.

2.7 Trends in Evaluation Studies

While it is still too early to assess the results of the current wave of evaluation studies, some clear trends are evident. Much less emphasis is being placed on the economic or health benefits of water supply projects. There is a strong trend towards the application of the simple empirical test - 'does it work?' and towards examining reasons for failure. This is being done in a variety of ways - questionnaire and protocol methods, quick on-the-spot field investigations, and a few in-depth studies. The latter are very few indeed, however, and seem to be focused mainly on technology (IBRD studies), and community participation (IRC). Of these, only the former has been financed and carried out. The IRC study is still in a formative stage.

Other trends include a stronger emphasis on the "software components, education, manpower training, institution building and relations with the local community. There is a growing recognition that these are important elements without which the resources of capital and technology can fail.

At the same time as the approach to rural water supply projects is broadening to include more attention in detail to more "software" components, the links to other parts of the rural development process are also being newly emphasized This applies particularly to the close link between water supply and sanitation, where it is held that the benefits of water supply projects will be severely curtailed if they are not also linked with sanitation improvements. Also involved is a recognition of the role of water supply and sanitation improvements in primary health care. All these elements have been recognized in the past, but they now seem to be deserving of more attention.

It seems likely, therefore, that as the results of evaluation studies are fed back into program and project design, the software components will be given an extra boost and a key criterion for success will be the continued operation and maintenance of water projects involving the collaboration of effective national organizations, and satisfied and knowledgeable local communities.

3. MAINTENANCE

A key to avoiding an embarrassing disaster in the International Drinking Water Decade is maintenance. A key to policy directions, therefore, is "software components", because maintenance is not one but many problems. The question we have to ask is, "Why are systems not maintained properly?" The issue of maintenance is an all-important and overriding variable in the success or failure of rural water supply schemes. The reasons for the failure of maintenance can be roughly classified into three factors - those of technology, capacity and motivation.

3.1 Maintainable Technology

If a simple technology ceases to function, the first and obvious place to look is at the technology itself and those directly responsible for its operation and maintenance.

Are we dealing with a straightforward case of inappropriate technology? In the lexicon of the critics of high technology, it is often asserted that the industrial nations provide assistance to developing countries for the acqusition of technologies which are too "high" or complex or advanced for the context into which they must fit, and that such high technology is too sophisticated for the local manpower which is insufficiently skilled or trained. This may indeed sometimes be the case. But the level of technology used in rural water supply schemes is inevitably rather simple. The idea that the technology is too complex for the simple rural folk of developing countries is a myth and a rather unconvincing myth at that. Broken and inoperative water supply schemes are to be seen in environments where village skills extend to maintaining and repairing bicycles, transistor radio sets, irrigation pumps, ceiling fans, air conditioners, and a variety of small industrial machines and tools. Anyone who has experienced the phenomenon of "bush mechanics" in Nigeria or elsewhere in Africa knows that basic mechanical skills are not as absent as is sometimes assumed.*

It is quite likely that in a few situations, the water supply technology is too complex for local skills or that local manpower of sufficient skill is in short supply. Certainly improvements are possible here. Such explanations do not carry much general weight or conviction, however, in most circumstances, and we must look beyond the technology/manpower dimension.

3.2 Capacity to Maintain

The word "capacity" is used here to cover a number of shortcomings and deficiencies in national rural water supply programmes which results in a reduced capacity or incapacity to undertake the maintenance function adequately. No matter how straightforward the technology may be, there are certain items of manufactured equipment which need spare parts and

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* Bush mechanics are men who have developed a capacity for repairing broken down automobiles on the road, where they stand, with a minimum of tools or equipment. Often they are living at the village level and work in teams substituting synchronized muscle power for the work of garage equipment.

replacements from time to time. These must be supplied from outside the community, usually be the national programme. But villages are often remote and inaccessible. They may not be served by all-weather roads, and they may well not have access to a telephone or radio link to the national capital or regional centre. If spare parts and supplies are on hand within the country, it may be difficult to keep all villages supplied with their needs at all times. Often the right parts are not available in the country, however, and must be ordered from overseas. Orders for external supplies may be subject to review and delay by another Department such as a Treasury Department, a National Bank and a National Planning Agency. Such procedures are often set up to conserve scarce foreign exchange. They introduce delay, sometimes extraordinary delays, such that when the spares do finally arrive, the equipment has been out of use so long that it is no longer repairable or capable of rehabilitation. The users have gone elsewhere.

Why then should not a national programme be able to ensure that it has enough spare parts on hand to avoid any such delays? There are several impediments to such a common sense requirement. First, supplies, spare parts and the getting of them to the villages are considered to be a difficult activity and responsibility from the construction of water supply systems. The construction of a new water supply is a glamorous, and politically desireable activity. It enables politicians or leaders at local and/or national levels to promise a new water supply, to provide a new water supply, and then to be seen cutting the ribbon or turning on the first tap on Opening Day. It is a once and for all activity which has glamour, visibility and immediate political benefit. By comparison, maintenance of the system is routine, unglamorous, not highly visible, and realizes no significant political benefit. Nor, surprisingly perhaps, does failure to maintain a system seem to yield great political cost. For reasons to be discussed below, when a system fails and villages return to the traditional system, it may be with some relief and satisfaction on their part. Meanwhile, the political leader is off at a flag-waving and ribbon-cutting ceremony elsewhere for another water supply or the opening of a school or a rural dispensary.

If this seems strange, it should be remembered that rural communities lacking water supply are often remote and inaccessible and are also lacking in much poltical power. The poorer and underpriviledged sections of the community

have an in-built tendency to remain poor and underpriviledged. Providing a new water supply appears generous and laudable at the national level. The political leverage to provide that the system gets what is required from outside to ensure proper maintenance is far more difficult.

The emphasis on construction and the lack of attention to maintenance is a feature of national rural water supply programmes that is often inadvertantly strengthened from outside by the well-intentioned efforts of aid agencies and international organizations. These external "helpers" have been active in encouraging the idea of "goals" or "targets" for rural water supply programmes. National governments are enjoined to develop plans under which all people will be supplied with improved water by 1990. External aid is also forthcoming for the development of the plans and the capital cost of their implementation. All too often insufficient thought is given to maintenance. Indeed there is often the expectation that maintenance will be the continuing responsibility of the national program (unaided) or the local community. Thus, the emphasis on construction goals can be reinforced by the external aid activity and the inflexibility of the loan arrangements that are made.

Recognition of these difficulties has led some external agencies (including AID) to be much more receptive to providing support for the "software" components of rural water supply systems, including institution building, manpower training, and health education. These developments probably need to be strengthened and taken further, although not without monitoring and evaluation of recent experience.

So what is here termed the "capacity" problem is a real one - or rather several real ones. Rural areas are often inaccessible and it is genuinely difficult to get supplies through, even if they exist at the national level. And for a variety of reasons, some rather compelling, the supplies and maintenance capacity does not necessarily exist at the national level. Inadequacies at the national level can be inadvertantly reinforced by the operation of external aid programs.

If this comprehensible but sad and frustrating tale of the difficulties of ensuring that a capacity for maintenance exists were not enough tribulation, there is yet another and more baffling obstacle. There are many actors in the aid business for water supply and as the International Drinking Water Decade gets underway, their number will grow.

In some developing countries there are five or six. sometimes more, different friendly national governments helping with the water supply program. It is commonplace to be told that U.S. AID is helping in one region by providing a project planning and identification team. Elsewhere a German drilling rig is at work. Here a private British group is developing wind pumps and there a Swedish SIDA team is providing pipes and diesel pumps. Elsewhere the Canadians are supporting a regional scheme using equipment of Canadian manufacture, and so on. The action is not confined to a group of national governments. Each foreign assistance project may be served by different consulting firms and different suppliers of equipment. The same is true for activities supported by UNICEF or UNEP (in cooperation with WHO) and a whole string of church-related private and voluntary non-governmental organizations. The result is often a bewildering and confusing array of helpers doing things their own way and leaving behind them such a variety of equipment, operating methods and maintenance requirements, that the problem of keeping a check on requirements for parts is itself of a magnitude and character such that no water supply agency in a developed country would find either acceptable or manageable. It is not efficient or cost-effective. Coordination among the external helpers is almost totally lacking and competition is the normal order of the day. This adds immeasurably to the subsequent maintenance problem. Of course, a strong-minded and well-staffed national organization might resist such a prescription for confusion. But often a national program can only be put together by dividing the action up among a diverse group of interested "donors". When Britain offers 300 hand pumps (of English manufacture, naturally) for a pilot project in the Southern Region, it is difficult or impossible to refuse on the grounds that, "we already have 1,000 Italian pumps in the Western Region"! This is especially the case in the absence of good field trials or equipment evaluations carried out in independent tests. For the purchasing department of the national water authority, there is no Consumer's Guide to water supply equipment. Certainly there are catalogues. But these are issued by the separate maufacturers and spell out the admirable qualities of the equipment they are designed to sell.

3.3 Motivation to Maintain

Beyond the factors described as technology and capacity lies the even more Alice-in-Wonderland world of motivation. Given all the problems cited above of the inappropriateness

of technology, the shortage of skilled manpower, and the "capacity" problems of accessibility, storage, exchange controls, goal orientation nationally and in external loans, multiplicity of designs, and so on, it is still clear that much more could be done effectively if the ingredient of "motivation" were more prevalent at the community level.

By "motivation" in this context, we have in mind a series of social considerations which adversely affect the performance of rural water supply systems. These include, first of all, the matter of "awareness". Village populations are often unaware or misinformed about the benefits of improved water supply. They certainly appreciate convenience. Or at least those members of the community (usually the women) who must walk some distance to fetch and carry water do. They are quick to recognize that a standpipe 20 yards away is better than a well or a stream half a mile or more away. Beyond that, however, water may be valued for its taste and appearance (i.e., not tasting of salt, or iron or chlorine, and not turbid) rather than its bacterial quality. Bacterially contaminated water which tastes good may be preferred to chlorinated "safe" water which tastes unpalatable. So education is needed in recognizing the health benefits of safe water supply. Were such benefits to be more widely appreciated or more highly valued, it seems safe to assume that rural communities would themselves make more effort to maintain the water supply systems. The fact that rural communities often do not do so, as we have suggested above, is not usually due to too complex a technology or to a lack of the requisite skills. Nor is lack of awareness of health benefits the whole question. It is not sufficiently appreciated by the national water supply programmes and their staff, and by the external helpers, that water supply has profound social significance at the community level. The way in which water sources are protected and used, the way water is distributed among different families, who has priority and who may use what source, are questions that go deep into the fabric of rural life. In a manner not appreciated by city-dwellers or technically oriented, modern-minded administrators or engineers, water is an intermediary of profound social, and sometimes religious significance. Water supplies and their use may have symbolic significance, and they may be intimately associated with the values of the community and its power-structure.

When an engineer from a national water authority innocently approaches the community leaders and inquires if they would like an improved domestic water supply, and then proceeds

to describe how a well or an intake will be built at one place, where the treatment plant will be sited, where the pipes will go, and who will be able to get water from which taps and standpipes, he treads often unknowingly on a complex web of sensitivities that can cause deep convulsions within the community. It is, of course, partly a familiar matter of who pays and who benefits. When a new highway is built in a city, some gain better transport and more accessibility, others benefit less but still pay more taxes, while others suffer an increase in noise, air pollution, or even the loss of enforced evacuation of their homes. Not only do new water supply systems impose such a familiar pattern of benefit and loss differentially among the rural community they serve, there is also much more. The power structure of the community may be upset. A family or a social group who gained their influence from control of traditional water supplies, or priviledged access to it, may stand to lose more than economically. Social lines may be transgressed, important taboos may be broken, and the very Gods may be offended.

Some examples of people's attitudes to a proposed rural water supply improvement scheme in India are reported for the Banki Piped Water Supply Project in Uttar Pradesh (Misra 1975). The project covers a group of seven villages with a combined population total of 4,420 (1964 consus). The views reported are generally opposed to the scheme. People were against having to pay for water which is a free gift from nature. Other views cited by Misra include the following: tap water is tasteless and of poor quality, while well water is cool and refreshing; our ancestors used well water and yet they were healthy and even stronger than us; people in cities use tap water and still the hospitals are full of patients; piped water is unholy because the washers are made of leather and this is why our ancestors never took tap water when they went on pilgrimage to cities; why is the Government so interested in providing us with tap water?; the scheme is perhaps related to the family planning programme of the Government; they may give us medicated water to reduce our fertility; the heads of the Panchayats have been influenced by the Government, but we know what is good for us.

(In spite of these initially negative reactions, Misra reports that through a process of health education and community participation the villagers were gradually won over to the support of the water supply project, to the extent that the people now assume full responsibility for the maintenance of the project, through a Waterworks Committee comprised of a Chairman, a Secretary, a Treasurer, and four selected members.)

Such concerns can, of course, be dismissed as superstitious nonsense or the undemocratic protection of privilege and unfair advantage. Improved water supplies are built in the name of Progress and Development, and quaint traditional beliefs and values and archaic social forms should not be allowed to stand in the way. There is much merit in this view. But if such factors are ignored or wished hopefully away, they will almost certainly re-emerge to cause trouble later on.

A water supply may be built, and it may meet the community's needs economically. It may yield health benefits and convenience and still be of relatively simple design, well within the capacity of the community to maintain. Local leaders and national figures may join in cutting ribbons and turning taps while bands play and children dance. Behind many such a joyful scene lurks the reality that the community or the community leaders are not convinced. They have not been involved in the planning or decision-making. Or the consultation that they were allowed was simply a window-dressing kind of token exercise which carried no weight with the real decision-maker. The community has not really accepted or adopted the new water supply system. It is "their system" and "their taps" and "their pumps" and not "ours". It is an alien thing. So when it needs repair, let them repair it. And when spare parts are required, let them supply them or find them. Before long the system fails. First some components go, then others. Finally, no water comes from the tap or standpost. The community goes back to the old sources, and once again the women and small children are to be seen laughing and chatting at the well or by the stream, and carrying clay pots of water on their heads back to the family compound, scarcely noticing the abandoned standpost as they go.

Perhaps if the community and its leaders felt a sense of responsibility for the water supply system, and perhaps if they felt possessive about it, more efforts would be made at maintenance. Some village elder would make it his responsibility to ensure that community resources were found and made available to obtain whatever hardware and skilled repair work was required. How much this would change the pattern of failure to maintain we do not know. Undoubtedly, however, local attitudes or local involvement is an important factor in some cases.

4. POLICY DIRECTIONS

From the foregoing diagnosis, several key policy directions are suggested. For the most part these directions are already being followed or explored at the field or country mission level. What remains unsure is their relative importance, and the vigor with which it is desirable to press in these policy directions. What is sure, is that the correct mix differs from country to country, and from time to time within countries. No clear blueprint of 'how to do it' is either possible or desirable. Flexibility is crucial. The following policy directions are, therefore, suggested as a preliminary outline. They are some bones which may be used in building an effective pattern of cooperation between U.S. AID and the host or recipient nations. Putting the flesh on the right selection of bones, and breathing life into the enterprise can only be undertaken on a country by country basis at the field level.

4.1 Technology and Manpower Considerations

There is a need to ensure that to the maximum extent possible the technology (hardware) chosen is appropriate to local circumstances, is cost-effective and imposes demands for maintenance no greater than can realistically be met by the community itself with the quality and quantity of external (national program) assistance that can routinely be expected.

It has generally been found that the chosen technology works best if it represents an incremental improvement of the existing level and can offer further step-by-step progress. Large advances in the sophistication of equipment and design seem to run greater risks of failure.

Closely associated with the technology to be used is the question of available trained manpower. Those who report on the success of water supply programs in Latin America attach a great deal of importance to the training of manpower, including high-level professional manpower, with a career-long commitment to building up effective organizations.

Manpower needs can differ widely from country to country, however. Sometimes the most pressing need is for village-level operations and maintenance personnel, more than highly-trained engineers.

In some countries the need for further trained manpower at all or several levels appears to be a key obstacle to more rapid progress, and especially to the adequate maintenance of installed systems.

Another obstacle to effective maintenance is the great diversity of equipment used within some national programs as a result of the diversity of external support. Attempts to reduce this diversity of equipment by the national programs themselves and by collaboration among the various external donors seems to offer the prospect of immediate gains in simplifying the purchase, stocking, and supply to the field of equipment and spare parts.

4.2 National Capacity Considerations

There is a need to do more to build up and strengthen the capacity of national water supply programs. Action to ensure that capacity exists may be required for some time before construction activities are supported.

It is increasingly recognized that without serious, long-term commitment of national governments and the creation of effective national program organizations, a rural water supply program may proceed in fits and starts. The good work achieved in periods of enthusiasm and national commitment may be lost or undermined unless interest and support can be sustained.

It is not only important to sustain commitment, but to ensure that the commitment is realistically expressed. A danger exists in the adoption of ambitious goals when these are not backed up by practical and realistic plans and allocations of resources.

National water programs often lack, through no fault of their own, the capacity to maintain an adequate supply of parts and equipment and to deliver such parts as are needed to the community or project level. Sometimes this is coupled with long delays in ordering and shipment of parts from overseas. A reason for lack of "spare parts" capacity at the national program level may be that the program does not carry enough weight in national planning and priorities, and that there is insufficient or unsustained commitment by national leaders.

Where priority and sustained commitment exists, strong external support can yield good returns. Where it is lacking, efforts to build it up should usually precede investment in projects as such.

4.3 Motivation

Careful selection of technology, career opportunities in water supply, strong commitment by national governments, and other actions at the national level can help to ensure that motivation exists to build and maintain water supplies.

Success seems more likely to be assured, however, if the motivation and understanding extends all the way to the village level. This can be achieved with increased attention to health education, to genuine community participation, and by making sure that knowledge of the social and cultural aspects of community life in relation to water supply is developed and used in program planning and project design.

4.4 Flexibility and Patience

If there is one underlying theme to those policy directions, it is that flexibility and patience are required on the part of external donors. It is clear that if more effort is to be put into community social surveys, into the development of community participation, and into properly designed activities of repair and maintenance, that there will be less money available, in aggregate, to buy pipes and pumps, the fuel for pumps and water program vehicles, treatment and storage facilities and the like.

Does this mean that fewer projects will be built and that the penalty will be slower progress towards national goals and international targets? Of course, it is possible that this may be a result. It seems unlikely, however. The constraints on progress in the next decade are likely to lie in the difficulties of implementation rather than in shortage of capital funds.

The opposite danger is probably more real. It is that in an urge to reach goals and targets, too much emphasis will be placed on getting the hardware into place and on the ground, and not enough in ensuring that once built projects can continue to function as intended.

It is also possible that the more external aid is oriented away from projects, as such, and towards sectors of activity in entire water supply programmes, construction would actually accelerate while proportionately less would be spent on hardware. If this seems unlikely or impossible to comprehend, reflect on the consequences of a project approach. The external aid agency procedures usually require an extraordinary amount of detailed information on projects to be funded. For village water supplies, this may be for large groups or numbers of villages taken collectively and not for single water supply schemes, as in the case of major urban areas. Nevertheless, in the interests of safeguarding the effective use of aid funds, and to maintain accountability, the donors usually require masses of information on the population to be served, on the technology to be used, and the procedures and schedules to be followed. Much of this information has to be guessed at, and many of the estimates made have to be dramatically revised as the projects proceed. A consequence of the use of the project package as a unit for submission, approval and disbursement of aid is ironically that the few skilled people in developing country national water supply organizations who can prepare such documentation are diverted from more useful and effective project planning activities (Feachem, et al. 1978, p. 253).

The policy which increasingly makes more sense, therefore, is one in which whole programs are supported and funds are allocated for institution building, manpower training, health education, community surveys and community participation, technology design, selection, local manufacture, and so on. The application and approval documentation then comes to consist less of project descriptions and more of program content. These might take the form of government policy documents outlining the principles according to which the program is to operate, including program goals, criteria for project selection, policy for community-level participation and management, the technical principles and standards according to which they will be built, the planned activity in each sector for the forthcoming accounting period and so on. (Feachem et al. 1978) Such documents are the agreed basis between donor and recipient for a loan, and would have in-built program performance reports to enable both donor and host to monitor, record, evaluate and revise the programme accordingly, while at the same time improving the recipient government's management of its development activities, and not forcing a straight jacket of project requirements which become difficult to change even when their unsuitability becomes apparent.

4.5 Reassurance for AID

The more that external support is attached to program and software, and the smaller the proportion of funds that goes into projects and hardware, the more difficult it becomes for external aid agencies and the taxpayers who support them to be assured that they are getting value for money.

Where projects are being built and pumps, pipes and taps are being installed and well drilled, a certain indication of progress or value for money can be obtained by simply counting the projects completed and project components installed. The money spend on health education, community participation, technology evaluation, manpower training and the like, is more difficult to justify and it is more difficult to demonstrate that it has been used effectively.

As we have seen, however, the number of pumps installed is not necessarily a good measure of the number of pumps that are working. While it may be easier to show impressive figures about the "hardware" components of a water supply program, a careful look behind the figures can reveal that they are no more firm or reassuring than more qualitative accounts of training, education or institution building.

Alternative ways of thinking about the success of external aid are, therefore, needed. This is a large question deserving in itself of more attention than can be accorded in this paper. Two suggestions, however, seem well worth consideration and further exploration and development. They are rehabilitation and consumer satisfaction.

As plans are being drawn up for new or expanded programs in water supply and sanitation, a part of the work could be an evaluation survey of the present status of existing projects or those built in the previous decade or more. Where such surveys reveal inoperative systems, breakdown or improper operation and maintenance, a part of the new program might be earmarked for the rehabilitation of existing systems. The ability to identify projects in need of rehabilitation, to provide some funds for the purpose and to carry such work through, can be a testing ground for the commitment of the national government and of the capacity of the national program organization.

Another approach is to focus on perceived benefits of water supply projects as distinct from the epidemiological and financial surveys that are made in some project evaluations.

It is a well-known phenomenon of work in developing countries (by anthropologists for example) that communities may put a higher priority on good, warm, friendly relations with outsiders, than on what external observers might describe as "objective truth". It is especially important, therefore, to create conditions in which true responses about perceived benefits of water supply (and sanitation) projects are elicited, rather than simple expressions of what the respondent thinks the interviewer wants to learn. This danger is all the greater if the community has been subject to a good deal of prior education about the health benefits to be gained from clean water. Perception surveys are likely to be fed back the information from the national water supply agency education program.

This is, of course, not necessarily a bad thing. The character of the response can also be used as a measure of the effectiveness of the education program - provided the responses are genuine.

5. SOME PRACTICAL STEPS

The steps that are now needed are more in the nature of creative and useful inputs than exhaustive evaluations of past practice. The policy directions described in this report are in general, it is believed, acceptable to day-to-day practitioners on the firing line, and indeed reflect much of recent and current re-thinking. If increased emphasis is to be placed on the directions indicated here, then what is most lacking is the means and methods to move vigorously forward in these directions.

5.1 Development, Testing and Selection of Appropriate and Maintainable Technology

Many efforts are now being mounted by a host of organizations, public and private, to improve the technology available for rural water supply and sanitation systems. AID needs to ensure that it is directly in touch with these efforts, is monitoring their progress and performance, and has personnel in a position to advise national program officers in developing countries about the availability of such technologies.

Linked closely with technology development is the testing, appraisal, and selection among the wide range of technology choices available. AID could discuss with national program officials how they might best go about selecting the hardware requirements for water projects, and be prepared where necessary to support the steps needed to step up technology evaluation and selection units within national programs.

5.2 Manpower Training

Manpower training programs probably are in need of expansion and upgrading in a number of countries. As a preliminary step, inquiries are needed to ascertain how much manpower can usefully be absorbed by national programs, and precisely what kinds of training and competence are required.

Once answers to these questions are established, there will probably be a need for a new teaching materials to be used in the training programs, including textbooks, demonstration equipment, field study outlines and the like. These are thought to be especially lacking in local languages and for the more elementary levels of technology.

5.3 Equipment Manufacture

In some developing countries, it should be possible to encourage and strengthen the local capacity to manufacture certain items of equipment needed in rural water supplies. Feasibility studies may be required to determine the appropriate mix of production and markets which represent opportunities for capital investment and entrepreneurial skills. External funds may be required for pilot or experimental projects, but in most cases opportunities can be created for private capital. This needs identifying and encouraging.

5.4 National Organizations

With the aim in mind of strengthening national organizations and programs, it seems important to identify the weaknesses of existing organizations to help remedy the deficiencies. These may lie in numerous directions. For example, in accounting procedures, in project planning, in ground water surveys and so on. Perhaps in some instances it would be useful to prepare a package of materials describing the structure, functions and methods used by successful national organizations.

5.5 Public Health Education

Probably a major need in public health education is the preparation of suitable materials (films, slide strips, posters, information booklets and brochures) that can be used at the village level. This needs to be ascertained at the field level and suggestions are probably needed about the kind of materials that public health education programs can use and would find most effective.

5.6 Community Involvement

There is much talk about community involvement and general agreement that more is required. Often it is to be expected that national water supply organizations will need help in the development of procedures for community involvement. Methods need to be worked out and various guidelines or other procedural manuals need to be prepared. Since no one system will suit all circumstances, different systems are probably needed on a national or sub-national (required) level.

5.7 International Collaboration

From the survey of evaluation studies underway by other organizations (as reported in section 2 above) and from information received about the projected activities of several bilateral aid agencies, international organizations and private groups, it is clear that the policy directions described in this report and the many steps that are required for their implementation, are widely shared. It seems clear, therefore, that unless some steps are taken to ensure full communication between these organizations and to institute collaboration where possible, considerable duplication of effort could occur.

Probably the single most important innovation that could be made for the International Drinking Water Decade is that all the agencies involved find an effective means of collaboration and coordination of their efforts. This is clearly needed at the country level, for example, in order to reduce or control the proliferation of different kinds of equipment. It also is desirable at the regional and global level in order to facilitate the transfer of ideas, training, technology, manuals or procedure, lessons from experience and so on, and to avoid unnecessary duplication of research and program development.

The creation of effective mechanisms for voluntary coordination is notoriously difficult. It is an area in which an initiative from AID would be welcome and perhaps

even effective. If such an initiative could be made to succeed, it would do more for the advancement of the International Drinking Water Decade than all the other ideas advanced in the paper.

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APPENDIX A

Some Problem Dimensions

On a world scale the provision of a safe and adequate supply of drinking water to rural communities has prove to be an extraordinarily complex multi-disciplinary problem which has so far defied easy or effective solutions. Ironically, the problem at the village level usually appears relatively simple and straightforward. In most parts of the world where there is permanent human settlement, water is physically present in large enough quantities. The technology for procurement, treatment if needed, and distribution to consumers is relatively simple, and the people don't need to be told that water is essential for life and health. Why, therefore, does a problem persist that has come to command a priority attention of national governments and international agencies?

A good deal of the frustration and confusion in the rural water supply literature and debate is caused by the variation in scales of inquiry. Many participants in the discussion have looked through a microscope, as it were, at a few villages often concentrated in one country or one region of the world. Those familiar with rural water supply problems in Nicaragua, or Kenya, or India, have specialized or microscopic knowledge. From this they are often invited to generalize about the world rural water supply problem.

Others, such as those in the World Health Organization, or UNICEF, or the policy staff of bilateral aid agencies, are trying to see the problem through a telescope. They wish to frame their plans and programmes in terms of a conception of the problem on a world scale. The attempt to combine bits of microscopic observation into a global picture has produced a wide diversity of views about the nature of the problem, and whenever a generalization is produced, there is always a commentator who can say, with unquestionable authority, "But it's not like that in Ruritania." Quite correct. Each rural water supply situation, each village is unique, and valid generalizations are extremely difficult to make. Policies based on oversimplified generalizations are certain to appear inept and poorly thought out when confronted with the rich diversity of real field situations.

In this section some of the main dimensions of the rural water supply problem are described. Failure to recognize these dimensions and to formulate policies and procedures that are adaptable to different sets of curcumstances is a major difficulty in development assistance for rural water supply.

A.1 Settlement Types

Designs for the provision of safe and adequate supplies of water depends a great deal on the type and problem of human settlement to be served. The World Health Organization statistics cited in a previous section are for rural water supply, where the definition of rural adopted is that in use in each of the reporting countries. In other words, no consistent definition is used (nor is it possible to devise one), and thus some communities considered "rural" in the data for one country would be considered "urban" in another.

Rural settlement patterns cover and range from dispersed to concentrated. At the lower end of the scale is the isolated farmstead or dwelling. It may belong in a group with others in a community; community identity and ties may be strong although there is a large distance between the homesteads or places of residence. In some parts of Tanzania, for example, a "village" may consist of 30 to 40 dwellings, none of which are closer than half a mile to each other. A similar dispersed pattern of rural settlement is found in parts of Latin America. In Colombia, for example, there are large areas of rural settlement in which the traditional village is completely absent and small farms are scattered widely over the landscape.

Elsewhere, in much of India for example, and in West Africa and Southeast Asia, the nucleated or concentrated village is normal. The village size may range from a few households up to 5,000 or 10,000 in population. Some Indian villages are of a size that would be considered small towns - and hence urban, in other countries.

It is necessary, therefore, to distinguish between dispersed and concentrated rural settlement. (Donaldson recognized an intermediate category which he calls semi-concentrated.) Clearly the technology or system design that is appropriate to dispersed settlement is not suitable for concentrated settlement and vice-versa. For isolated dwellings, various types of individual systems are preferred, including roof catchment systems and wells. Genuine community systems

including piped supplies and possibly treatment, are usually only thought appropriate for concentrated settlements. Clearly, however, a dividing line has to be found in some instances between dispersed and concentrated settlements. It is at this point that rural water supply programmes impinge upon government settlement policy. Some governments (an outstanding example is Tanzania) have decided that in order to provide rural populations with better services (schools and dispensaries as well as water supply), they should be made more concentrated. Hence, the policy of "Villagization" in Tanzania. It is clearly important that water supply technology be selected according to the prevailing settlement pattern and in a manner harmonious with government settlement policy.

This is also the case where the more intractable problem of nomads or temporary settlements is concerned. The provision of water supply points (for human an cattle consumption) in areas of nomadic or semi-nomadic pastoral groups can have deleterious ecological or environmental effects if not carried out carefully. Harmony with government settlement policy is essential.

A.2 Wealth and Accessibility

Another important variable is the wealth of the rural community and its accessibility to markets and the modernizing ideas emanating from cities being disseminated along routes of transport and communication. Commonly, wealth and accessibility are highly correlated. Thus, the village on a main road within a few score kilometers from a major city is likely to be able to contribute more towards the cost of improved water supply, is likely to demand or expect a higher level of service, and is in a position to be supplied with spare parts and replacements when needed. The reverse is true for the poorer and more remote settlements. It may be an act of temporary charity to install an improved water supply system in a remote village where it has no chance of being properly maintained.

A.3 Water Availability

An enormous range of variability is found in water availability. In equatorial rainforests in Brazil, water is usually abundant on the surface all year around. It can be obtained from streams or simple roof collection systems with little difficulty. The fact that rain falls almost every day ensures there is no physical problem of water availability.

In many parts of the developing world, however, there are constraints on supply. There are dry seasons with little or no rainfall. As the desert margins are approached, the dry season becomes longer and the probability of sufficient rain every year becomes less. This transition is well demonstrated in Nigeria. In the Southern coastal areas, there is abundant and reliable rainfall. In the North the Fringes of the notoriously, drought-affected Sahelian zone are reached. Similarly in India, as one moves West and Northwest from Bengal along the Ganges valley to Delhi and beyond, the certainty of the monsoon rains diminishes and the probability of dry years or monsoon failure is offset by the availability of generally good quality ground water at relatively shallow depths. The alluvial plains of the Ganges and tributaries are a natural reservoir for ground water, and fruitful wells may be easily dug or drilled. In the South of India, however, the alluvial plains are replaced by the crystalline rocks of the Deccan Plateau. These rocks present more difficult problems for well drillers; the likelihood of finding a good supply of ground water is much less.

Availability of water is thus a function of both climatic regime and variability, and of geological and soil conditions. These latter are distributed in a highly irregular manner and change dramatically over short distances.

A.4 Community Organization

The design, installation and management of a community water supply system can be carried out without reference to the organization of the community itself. Indeed where community organization is lacking it is sometimes necessary to proceed without community involvement or to take the time to create the necessary community structure.

Usually, however, some form of community organization exists and inevitably becomes involved in the water supply improvement project, either as a helper and promoter or as an obstacle.

The design and implementation of a community water supply system and its generation and maintenance (especially the latter), therefore, depends on community organization and structure. In some countries there are well-established systems of local government of the sort that is familiar in Europe or North America. This is rare, however. There exists a wide range of local community organizations, including traditional tribal structures with chiefs and elders,

indigenous peasant-community democracies, sharply stratified social systems with a ruling group of high status families or individuals, and so on. In some countries the traditional tribal structure is in a process of being supported by modern systems of local government, sometimes based on a one-party political system as in the TANU organization in Tanzania.

There can also be sharp differences within countries. In Peru, for example, the communities on the coastal plain consist of mixed populations of European (Spanish) and Indian ancestry. These mulato communities have no traditional organization in contrast with the Inca Indian communities in the interior mountains where the traditional (largely democratic) systems still prevail.

A.5 An Approximate Typology

Using the four broad problem dimensions of settlement type, wealth and accessibility, water availability, and community organization, and simply dividing each of these into two categories, a typology of sixteen rural water supply situations can be readily created as shown in Figure 1.

Clearly, the two-fold categorization of each of the four dimensions is an oversimplification, added to which there are other important dimensions. The four selected are probably of primary importance, however, and from such a set of criteria one can immediately begin to zero in on such questions as the type and scale of technology to be used and level of service to be provided (dependent upon settlement type, community wealth and accessibility). Similarly, whether the system is to have water storage capacity and treatment depends on communith wealth and water availability. The type of system to be established for operation and maintenance also depends on community organization and so on.

The great variety of water supply problems to be solved, however, precludes any easy generalization about the methods to be employed. Some general policies, guidelines and procedures can be developed, but flexibility in application and ability to respond to local circumstances in adaptive ways is clearly essential to any successful programme. It is not for telescope users to tell those who use microscopes what they must see.

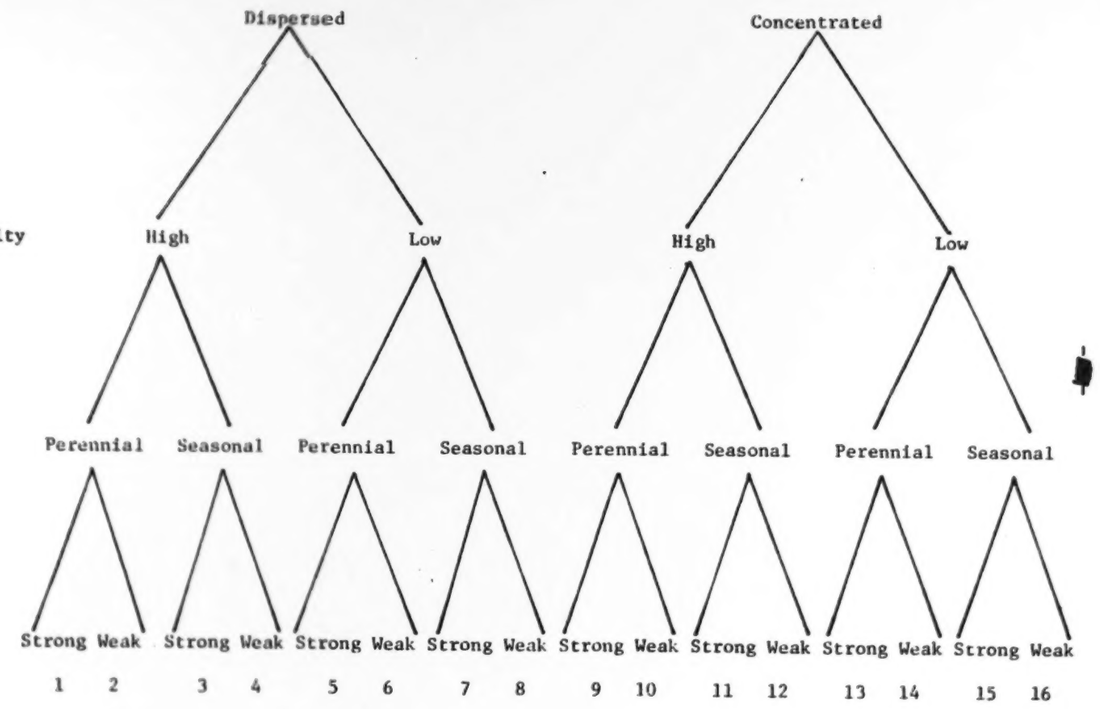

Figure 1. An Approximate Typology of Rural Water Supply Situations

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